DEXORY

Robotics and Automation

A revolution in logistics and
warehouse management

March 2022 (updated August 2023)

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1 Executive summary

In the 2021 World Robotics Service Robots Report published by the International Federation of Robotics (IRF), the logistics and warehousing sectors are reported to be seeing a boom in autonomous mobile robots (AMR). Robots are changing the way the industry operates - improving efficiencies and sustainability, and making work safer and more rewarding in a wide range of roles across the industry sectors.

In warehouses, robots are used across all stages, from receiving to putaway, stock taking, replenishment, picking and packing and even outbound. Developments in hardware and software now enable them to identify and correctly handle non-standard shapes, with the ability to increase productivity. Robotics and automation can take over the dull repetitive tasks, freeing the workforce to focus on more rewarding, higher-level work. They can also assist in order fulfilment, stocktaking and customer services, and picking-for-order fulfilment. There are even a number of robotics solutions operating in 'last mile' delivery to the recipient's door.

Robotics and automation generate data that can be used to gain a real-time overview of performance across the entire process. The benefits are numerous: less waste and increased efficiency in processes, and better quality and safety for the workforce. They are part of new business models that can help companies remain competitive while optimising their processes, space utilisation and overall offer.

With a business case that sees lowered upfront costs as well as on an ongoing basis - including new leasing models affording companies greater flexibility - the ROI of automation and robotics has increased significantly, encouraging an exponential growth of adoption. Limited visibility of goods' journey affects every step and stakeholder within the supply chain.

A 2020[1] survey showed that warehouse automation is expected to become an increasingly desirable option to the manual alternative over the next 2-3 few years. The warehouse automation market is expected to grow from $15bn in 2020 to over $70bn in 2025 (Interact Analysis, 2021).

This broad interest in warehouse automation is very encouraging and the survey findings also indicate that changes in the operating environment - such as labour costs, labour shortages, and increased throughput requirements - are primary influential factors.

They are also the factors that make it feasible for the industry. The current advancements in automation, which have brought about lower costs and scalability improvements, are conveniently supporting the change towards innovative approaches in warehouses and the logistics industry in general.

Much of the hesitancy in the industry stems from a lack of knowledge about the new technology, and a fear of the potential risks it raises in terms of return on investment, costs, impacts on workforce and general market competitiveness.

In this white paper, we take a closer look at the arguments and the technology, and explore proven solutions that are available now.

2 Introduction: Robotics and automation

ROBOTICS AND AUTOMATION - a revolution in logistics and warehouse management

The logistics, warehouse and eCommerce markets have experienced unprecedented growth over the last few years. This was mostly driven by the surge in eCommerce in response to the pandemic and restrictions, as well as by the industry's growing need for efficient warehousing, inventory management and real time data. The unrelenting pressure has magnified existing cracks in the supply chain and created new ones. It is also escalating a need for a review of the industry's resources, structure and processes, looking for efficiencies as it resists buckling and adapts to changing dynamics.

EXAMINING THE CRACKS

Across the supply chain there are visible signs of these fractures - from challenges in stock changes, a necessity for more efficient processes and space optimisation, along with restrictions on workforce - with the resulting expanded expectations on deliveries.

There is a shortage of tens of thousands in the warehouse workforce, raising wages and overall costs by up to 20%[2].

Warehouse space, already at a premium, is scarce. It is estimated that there is only about 18.1 million sqft of space available in the UK at 2022[3], despite the building of 11.1 million sqft built in 2021*. Although this is the equivalent of 26 Wembley Stadiums; nearly 75% of this space has already been let or is under offer at the start of 2022.

In addition, billions of dollars are lost annually in the logistics industry due to the lack of real time data on warehouse operations and crucial logistics nodes[4]. Coupled with other major concerns that include the ability to quickly identify and act on problems in the warehouse, logistics and wider supply chain early on, it is easy to see why the industry globally is looking for solutions, and seriously considering robotics and automation.

During 2020-21, there was a noticeable spur in research on these topics, accompanied by an increasing number of organisations investing in robotic technology. Headline findings globally show the extent of this interest.

[2] https://www.reuters.com/world/uk/british-warehouse-worker-shortage-triggers-up-30-pay-spike-2021-09-27/
[3] https://www.colliers.com/en-gb/news/10-01-22-race-for-space-for-occupiers
[4] IBM Case Study for Maersk, 2021

2 Introduction: Robotics and automation continued

IMPROVEMENT IN EFFICIENCIES AND THE INTERNET OF THINGS

There is strong evidence that improvements in processes, efficiencies and real time data can have an immense and immediate impact. The benefits are long-lasting and can ease the pressures to keep the supply chain going. All these factors are increasing the adoption of warehouse robotics and automation.

RETAILING AND ECOMMERCE DYNAMICS

The use of Industrial Internet of Things (IIoT) technologies allows warehouses to become better at managing and performing a multitude of tasks, improving the operational efficiency by huge margins. They have real-time data transfer, flexible communication, and Big Data analytics. These, along with the cloud-based solution, enable automated, sophisticated, and agent-based control.

The eCommerce growth has shone the spotlight firmly on two fundamental requisites: speed and accessibility to a broad and wide range of products. eCommerce also creates spikes in systems, reaching crescendo levels at peak seasonal dates for retail that include Black Friday, Valentines, Easter and Christmas periods, etc.

The industry has moved swiftly to build capacity and find ways to optimise space to service those peaks. In such cases, the benefits for increased automation in picking, packing and sorting are more than obvious.

2 Introduction: Robotics and automation continued

RACE TO TECHNOLOGY

Technology has not stopped innovating and there will be more areas along the supply chain that can be further automated in years to come. While the technology may be cheaper in a few years' time, first mover advantage brings substantial rewards. There are also innovative business models such as Robotics as a Service (RaaS) that would allow them to dip their toes in without major investment.

COPING WITH OMNI CHANNELS

Most retailers have reacted to the eCommerce growth by offering consumers the ability to purchase and receive delivery through any channel. This is apart from consumers visiting their bricks and mortar stores and purchasing in person and taking it away with them. This new norm is creating complexities in the supply chain as retailers adapt to provide faster deliveries and build new fulfilment centres to cope with the flows.

ORGANISING THE WORKFORCE

A recent Harvard Business Review study looked at the effects of automation on warehouse workers[5]. There are millions working in warehouses globally. While there has been some prior studies which have explored the impact of automation on these workers, there is still limited understanding of how automated technologies are changing these employees' daily lives. Concerns range from fear of job loss to inadequate training resources which would reduce their ability to succeed in this new digital and high-tech environment. Then, there is also the fear of unreliable technology where if it breaks down, workers would not be able to fix it and get their work done effectively.

[5] https://hbr.org/2022/02/research-how-do-warehouse-workers-feel-about-automation

3 The technology

DECIPHERING AUTOMATION

Automation is defined by the British Automation and Robotics Association (BARA) as an automatically controlled operation of an apparatus, process or system by mechanical or electronic devices that can take the place of human labour. In short, it refers to technology applications where there is minimal human input. This includes business process automation (BPA), IT automation and much more.

- **Basic automation** is when simple, uncomplicated tasks are automated. It is about digitising work using tools that streamline and centralise routine tasks. They include Business Process Management (BPM) and Robotic Process Automation (RPA).

- **Industrial automation** is the elimination or reduction of repetitive manual processes/tasks in an industrial environment or application through the substitution of labour with capital.

- **Discrete automation** defines the assembly of components into 'accountable units'. It focuses on the speed and positioning of assembly, where most parameters, e.g. component positions, are fixed. Discrete automation is the automation of fixed individual events.

- **Process automation** manages business processes through dedicated software and business applications to bring uniformity and transparency. It can increase productivity and efficiency within businesses as it delivers insights and suggests possible solutions. Process mining and workflow automation are types of process automation.

- **Integration automation** is where machines are programmed with rules to mimic specific human tasks and repeat these tasks until the rules are changed.

- **Artificial intelligence** (AI) automation is the most complex level of automation. The addition of AI means that machines can "learn" and make decisions based on past situations they have encountered and analysed.

- **Real-time digital twin** is a real-time, virtual representation of objects, processes, and systems that can help organisations monitor operations, perform predictive maintenance, and improve processes. Enriched with data, digital twin informs decision-making by helping to understand the past, observe and monitor the present and predict the future.
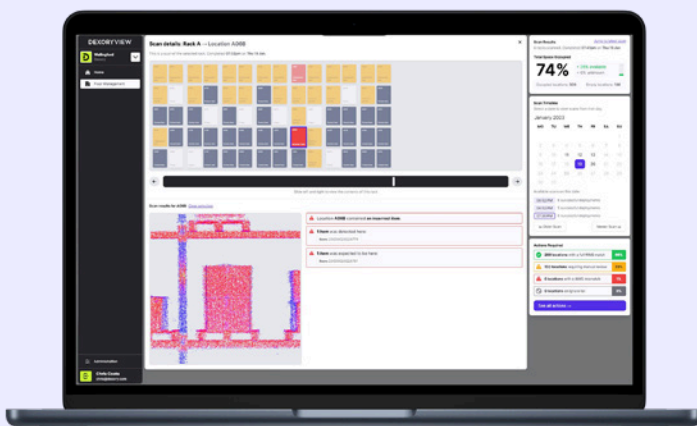
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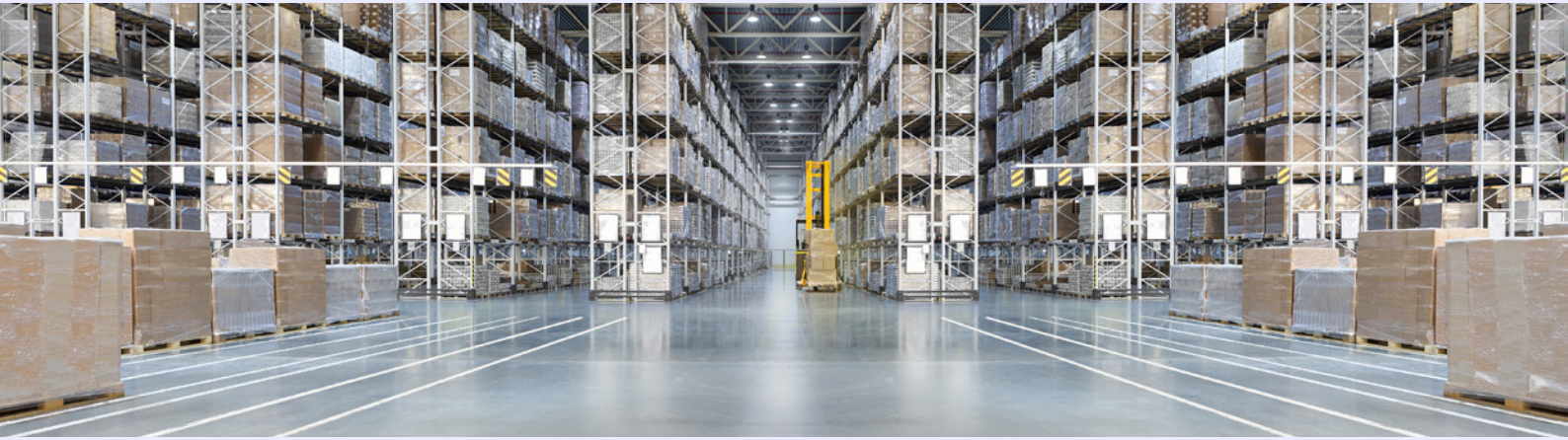
UNRAVELLING ROBOTICS AND AUTOMATION

Research by Forrester has found that automation - including robotics, artificial intelligence (AI) and Machine learning (ML) - is already a defining industry trend that will continue to expand in the next two decades[6]. It is also one of the most popular choices for improving operational efficiency with tactical automation.

EASING THE PRESSURE

At first glance it would appear that the only way for companies to ease the pressure will be to introduce big changes to the way they operate along the supply chains.

At the same time, automation in logistics and warehousing present immediate solutions and immense opportunities for early adopters. Companies can differentiate their propositions through improved services, efficiencies throughout the workforce, space optimisation and high-speed fulfilment:

From the automation of inventory into, within, and out of the warehouse and then onwards to customers with minimal human assistance, to the labour-intensive tasks that involve repetitive physical work, manual data entry and analysis.

Companies can also improve operations by minimising human errors with real-time data.

For the early adopters and those willing to start mitigating the risks, the required solutions are already available.

- **Automation** increases productivity and reduces costs by providing real-time data, enhancing efficiencies and optimising space utilisation.

- **Robotics and AI** can handle repetitive jobs and learn how to deal with unusual situations. Together, they free companies to focus on prioritising business initiatives and optimise operations by creating more opportunities and retraining the workforce for higher-level jobs.

- **Real-time digital twins** can provide immediate valuable opportunities and insights for better planning and space utilisation, all of which improve the flow of goods, use of storage and available space.

- **Detailed simulation** of actual warehouses use live data to predict dynamics and enable understanding, learning and reasoning. This is a process often undertaken by the business once, after which it is rarely updated or used to its full advantage.

The value of using the digital twin lies in updating it daily and comparing it with the previous day's data, to benefit from the real-time insights. As a result, the company can optimise its present operations, de-risk the future, and discover the intractable in each location.

4 Applying automation: Robotics benefits and applications

DIGITAL TWIN IN SUPPLY CHAIN

Digital twins bring immense benefits to the whole supply chain. A digital twin utilised across the supply chain in real time will deliver across five key areas:

1. **In depth understanding** of asset movements globally; bottleneck discovery; alerts for risk; cash to serve and cost to serve

2. **Optimal control** where there is an overview of all operations globally accessed in one click, feeding into organisations' control towers.

3. **Ongoing testing,** where design changes are analysed immediately for continuous improvement and development.

4. **Accuracy in forecasting,** providing a better handle on supply chain dynamics and behaviours as well as transportation schedules.

5. **Optimised planning** of inventory; risk monitoring and testing of contingency plans for maximised performance.

MAXIMISING THE BENEFITS

Resolving the space issue

In an environment struggling with space restrictions and short-term storage, the control of information and real-time data is the panacea for companies to fully utilise the space and keep stock moving. By adopting smarter approaches to storage solutions that include **autonomous data collection and digital twins**, they can utilise space and delivery schedules to free up warehouse capacity. There is better control on the flows, maximising the space utilisation and reducing the need for extra space creation – immediately eliminating potential large capital outlays.

The digital twin complementing and augmenting feeding directly into the Warehouse Management System (WMS) is an efficient and cost-effective tool for visualising problems, proposing solutions, and practising risk-free testing.

In addition, the supply chain digital twin will deliver real-time understanding, control, testing, forecasting and planning across the entire estate of warehouses and the full supply chain.
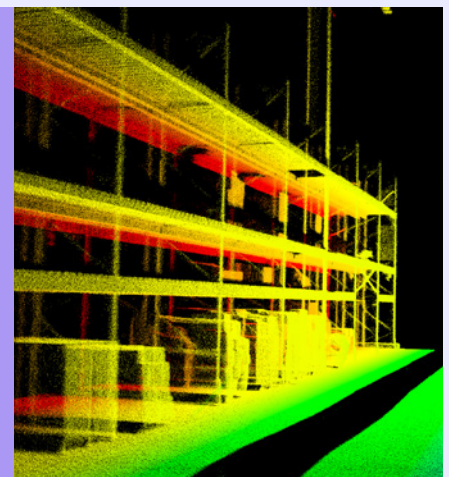

CURRENT WAREHOUSE MODELLING
- **One-off simulation**
- **Static**
- **Local**
- **Outdated**

DIGITAL TWINS
- **Continuous: real-time info**
- **Dynamic: alerts, notifications**
- **Centralised: can contain all operations globally**

4 Applying automation: Robotics benefits and applications continued

SAVING COSTS

Automation and robotics solutions reduce costs, time and inaccuracies. Apart from the space optimisation, companies can also see that once tasks that are manual, paper-based and labour intensive are automated - such as measuring pallets for dimensional accuracy – they free the workforce to focus on more complex value-adding tasks. There is also a higher level of enhanced accuracy and transparency, both of which deliver increased revenues that would otherwise not be realised.

A cargo warehouse today loses hundreds of thousands of pounds from assets with under-reported dimensions. Robots and automation can solve many problems:

Lead to better inventory control, where goods with underreported volumes can now be easily identified.

Track and detect goods across the warehouse, providing full, remote visibility in real time.

Cut down on errors in logistics such as early detection of non-compliant goods.

Ensure that relevant stock is always available to pickers.

Same with damaged goods for insurance claims, robotics and automation allow for the recovery of revenues that would otherwise be lost or identified too late in the process.

The pandemic, resultant shortages and restrictions have brought home the immense value and benefits of real-time data, automation and robots to manage processes, as well as track and identify gaps and areas of concern within the supply chain.

Their application has also highlighted the fact that robots can carry on operating even in a pandemic, freeing the workforce to focus on the value-added work and management of the processes.

At Dexory, we see this as a crucial time for the warehouse and logistics sectors to keep pace and invest in automation and robotics to remain part of the supply chain redesign that will make them smarter and more resilient.

"

By controlling the movement of goods in any warehouse space using autonomous data collection and digital twins, companies can maximise the space utilisation and reduce the need for extra space creation.

"

DEXORY

Huboo

Dexory uses data-led robotics and AI technology to optimise operations at Huboo warehouses

Dexory has deployed its fully autonomous state-of-the-art robotic system across the Bristol-based Huboo network of warehouses and fulfilment centres. The technology identifies gaps on shelves in real-time, and utilises that data to optimise Huboo's usage of storage. Huboo receives additional immediate insights on storage of goods in their space which feeds into their optimisation programme.

Huboo is a fast-growing and award-winning fulfilment provider based in the UK and mainland Europe. Since 2017, they have revolutionised the world of eCommerce fulfilment using environmentally sustainable methods that support a wide range of online retailers, including leading businesses in electronics, food & beverage and cosmetics. As they manage their expansion, they have deployed Dexory's UK-manufactured robotics and AI technology to optimise their warehouse systems and realise increased revenues, maximised efficiency and reduction of costs.

Current trends clearly indicate that the future of logistics must be digital and fully automated in order to succeed. **Paul Dodd, CTO and Co-founder of Huboo said,** "During the pandemic, we clearly demonstrated the strength of our full-stack fulfilment solution at a time when the industry was facing severe challenges. Our unique hub model system has certainly made us stand out in our competitive industry. We are now expanding our service offering and continue our software development. Our engagement with Dexory and use of their robotics and AI is helping us optimise our system and deliver a better working environment."

Oana Jinga, Dexory's Co-Founder and CCO explained, "Our autonomous solutions for streamlining warehouse operations will save millions per warehouse every year. Our autonomous robotics platforms and computer vision are revolutionising acceptance and tracking processes in warehouses. As our solution at Huboo is clearly demonstrating, the use of technology in such an environment liberates us from dull, repetitive work so that we can focus on the things that truly matter.

4 Applying automation: Robotics benefits and applications continued

ACCESSING REAL-TIME DATA

Delivering insights and data in real-time is now considered mission critical within the industry. 'Continuous Improvement' teams complain they lack the real-time data to understand where problems and opportunities lie within their operations.

Real-time data drives actual positive business impact and keeps the supply chain delivering to retail and industry. This is especially true for retail and eCommerce fulfilment and micro-fulfilment companies which are often tech-enabled and highly data-driven.

Following the Covid-19 pandemic, Gartner (2020) states that "having a 360-degree view of the entire supply chain network is of paramount importance."

> **At least 69% of companies are currently looking to improve their inventory control, as a more specific action to lower costs.**
>
> **Logistics Management 2021**

Many logistics operations waste time and human resources trying to locate goods in warehousing locations. Companies also suffer from revenue reductions when incorrect goods arrive at the locations and need repacked for outbound delivery. Without correct real time data collection, time and effort is wasted, resources underused, and deliveries subjected to delays and financial penalties.

LEVERAGING ASSETS

Asset retrieval inside warehouses is an area of concern for loss prevention and productivity boost. Studies show it can take up to 24 minutes to track and find a missing pallet (DSV, 2020), whether lost or misplaced, and a full warehouse-stock check can take on average 6.4 weeks with a team of 2FTEs/shift. (ASDA< 2021).

There are significant cost savings to be made when robots can navigate warehouse floors to capture the assets' real-time location.

Goods are often difficult to find in large warehouse estates, posing significant strain on the time it takes to prepare built-up pallets for outbound shipments. With the logistics industry transitioning to B2C models where customer expectations are for same day deliveries (Deloitte, 2019), warehouse managers are under a lot of pressure to ensure stock is processed in record times.

MANAGING THE WORKFORCE

In a climate of chronic labour shortages (Supply Chain Briefing, 2021), leveraging the current workforce is a priority. Companies can prioritise operators' work by saving significant unproductive time wasted on manual processes.

Data from actual studies shows that up to 40 weekly hours are saved per operator with autonomous label scanning (Case Study/Vision Systems Design, 2021); and at least 6000 hours are saved per year per warehouse with autonomous inventory checks (IAG, 2020).

5 DexoryView – Dexory's solution: How it all works

Dexory has developed the DexoryView solution and it's a one-of-its-kind platform. Providing access to a real-time representation of the state of your warehouse via an intuitive, easy to access digital format, which is fed with real-time information captured from warehouses, through the use of autonomous robots.

The platform automates data collection and builds real-time digital twins that unlock insights across all levels of warehouse operations. Dexory's robots measure, count, track and find inventory across warehouses as they navigate the racks, without workflow disruption.
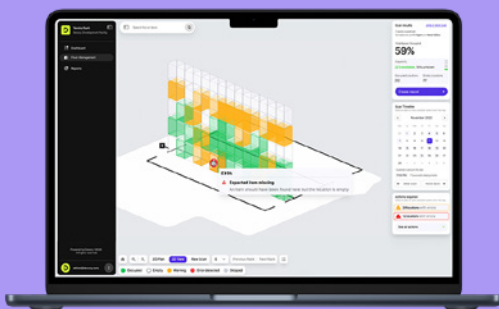
The data is pushed in real-time to our DexoryView warehouse digital twin platform, offering end-to-end visibility across the state of the operations in an intuitive, easy-to-access digital format. The insights extracted help discover inefficiencies across the warehouse, optimising operations and de-risk the evolution of a company's supply chain.

The autonomous robot scans and collects real-time data, creating an overview of processes and inventory in any warehouse. It measures, tracks and locates items throughout operations, adeptly navigating around people and machinery. This constant mapping and scanning enable quick identification of stock, through the detection of various labels like RFID and barcodes. The robot captures data on parcels, pallets, and products as it passes through the warehouse, scanning multiple barcodes at varying heights. It instantly provides accurate information on item condition, volume, dimensions, and shelf placement, expediting shipping, optimising warehouse space and reducing costs. This data seamlessly integrates into the WMS (warehouse management system) or Dexory's digital twin platform, offering instant analysis and comprehensive inventory visibility from anywhere.

This allows companies immediate and up-to-date access to their inventory - across all stages of the goods' journey in the warehouses – from anywhere and at any time. Not only does this enable companies to automate their stock checks, but it also keeps track of occupancy, increasing efficiency and helping to facilitate profitable operations.

5 DexoryView - Dexory's solution: How it all works continued

OUR SOLUTIONS AS PART OF THE REDESIGN

Dexory is a full stack solution provider with a cutting edge data collection system to boost warehouse productivity. Our solution is unique, fast and easy to implement and scale.

We use cutting-edge engineering, state-of- the-art robotics and AI products to make robots more useful, accessible, and intuitive for humans to work alongside in warehouses.

With no complex infrastructure changes required, our fully-autonomous solutions are cost-effective under a full-service subscription offer (RaaS) and unlike any alternative solutions, are easy to install and scale.


A fully autonomous robot can detect its environment, make decisions based on what it perceives and/or has been programmed to recognise, and then act without human intervention.

HOW IT ALL WORKS

A seamless solution, fully integrated into the warehouse processes to cause no disruption. Automating inventory management:
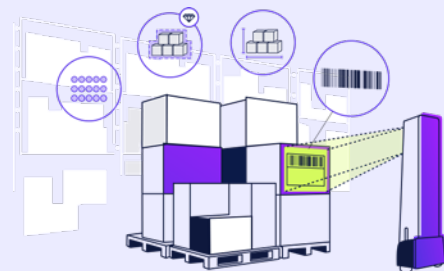
Robots navigate autonomously, avoiding obstacles and scans warehouse locations
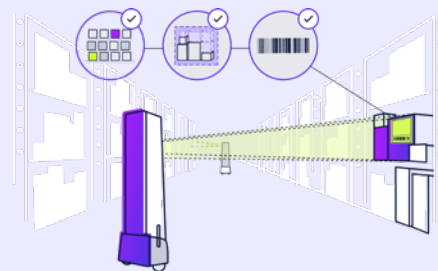
Perception system identifies assets/gaps and places them on 3D maps

Data is integrated into WMS to close data loop

Easy to implement and scale

14

CONTROLLING INVENTORY

69% of companies are looking to improve their inventory control, as a more specific action to lower costs (Logistics Management, 2021). We know that asset retrieval inside warehouses - whether lost or misplaced - is an area of concern. Our aim is for loss prevention and productivity boost.

With our robots, there are significant cost- savings to be made as they navigate warehouse floors to capture real-time location for assets. Right from the beginning, there is immediate gain in terms of revenue recovery from lost, misplaced or non-compliant assets.

The bespoke design robotic platform and stack system integrates seamlessly into warehouse operations. The data flows continuously from the robot, which can quickly measure, track and find goods without any infrastructure changes. No human effort is required to get this continuous stream of data.

Automating inventory processes immediately leads to increased productivity and efficiency. There are several examples where the adoption of automation has eased the pressure on resourcing and efficiency.

It is also easy to see how once tasks that are manual, paper-based and labour intensive are automated - such as measuring pallets for dimensional accuracy - it frees the workforce to focus on more complex value-adding tasks.

SCALABILITY

DexoryView is part of a solution that can easily be customised and scaled up to meet the warehouse's specific requirements.

Designed as a cloud-based platform, DexoryView provides central administrative control of 1000+ devices to ensure seamless scaling of operations and access to data for all relevant teams.

Our platform provides a distributed system consisting of communication agents running on our fleet of autonomous robots. Using secure, encrypted and real-time communication channels on our platforms, the robots seamlessly exchange information and tasks. The high-performance platform allows the robot fleet to make decisions faster than other systems available on the market. Real-time information from each robot is available instantly on every other robot in the fleet, allowing each robot to build a full picture of what is happening across an entire warehouse.

6 Summary

SUMMARY

DexoryView improves productivity, drives efficient space utilisation and provides early detection of non-compliant assets with real-time access to warehouse data.

- Our technology includes **full integration** with current workflows, with no operational bottlenecks or disruptions and no major infrastructure changes required.

- With **minimal changes to normal practice**, our robot-service model allows companies to fully leverage their current workforce and instantly digitise 100% of their assets down to cm accuracy.

- Coupling autonomy and mobility with state-of-the art ML and computer-vision capabilities and AI data processing, our solutions are able to **easily scan and accurately detect all types of labels** (RFID,QR/barcodes).

- DexoryView works seamlessly among heavy machinery (i.e. forklifts) and humans (operators). Our robots are **fully-autonomous**, so there is no need for operators to carry and hold their tablet or smartphone around the warehouse to track and find pallets.

- Unlike other solutions, we are not restricted by a single use case or environment specifications and **will operate in any dynamic space or warehouse style.**

- Mobility ensures there are **no bottlenecks to disrupt warehouse operations.** There is no need to process all goods through a single point or sacrifice warehouse space to accommodate robots.

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6 About Dexory

Dexory (formerly known as BotsAndUs) is now a rapid-growth technology company based in West London, that provides real-time insights into warehouse operations using fully autonomous robots and Artificial Intelligence for the logistics industry.

Dexory's fully autonomous mobile and modular robots measure, track, and find goods across warehouses without workflow disruption. The company's latest offering, the DexoryView platform automates data collection and builds real-time digital twins that present insights across all levels of warehouse operations, making it quick and easy to respond to operational challenges on a daily basis.

Instant access to real-time data helps optimise the present, de-risk the future and discover the intractable in each location and at every stage of the product journey through the warehouse and onto dispatch. Founded in 2015, Dexory aims to transform the data-gathering operations of warehouse environments.

Working with major industry leaders such as Menzies Aviation, Maersk, Huboo, and a number of other logistics and warehousing companies in the UK and across Europe, Dexory provides solutions that optimise warehouse operations by integrating automation, data intelligence and digital twin technology.

www.dexory.com
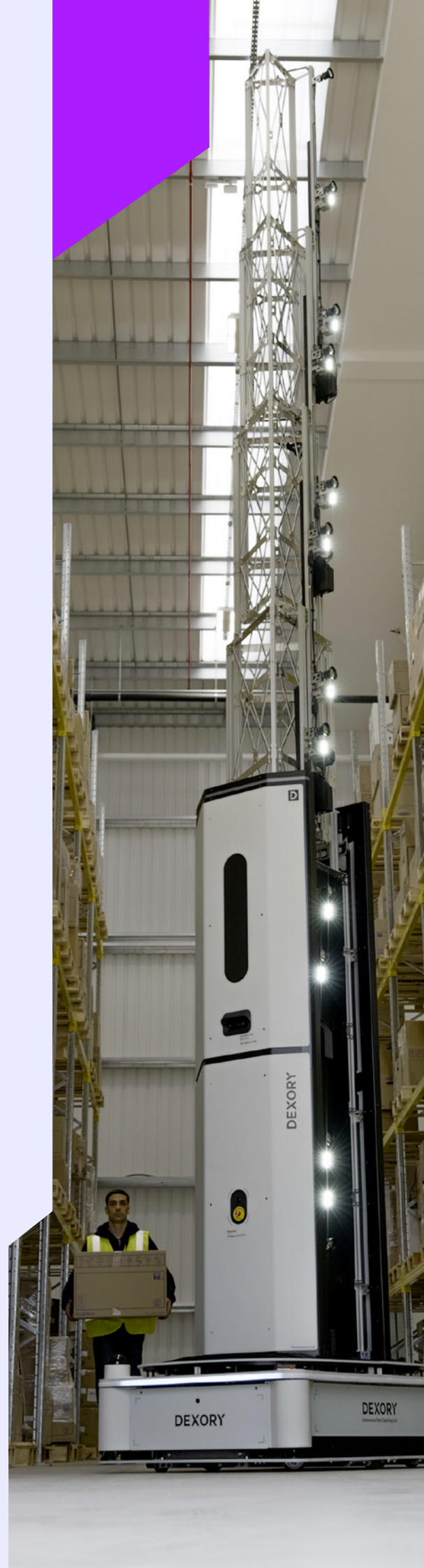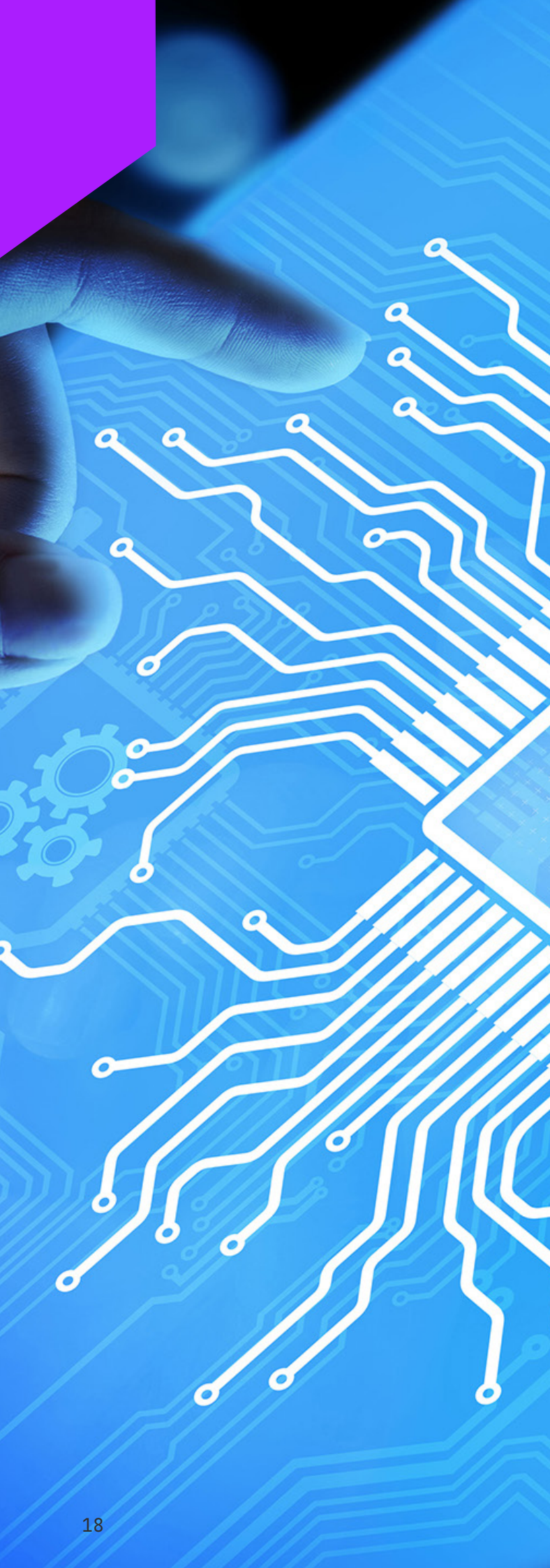
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